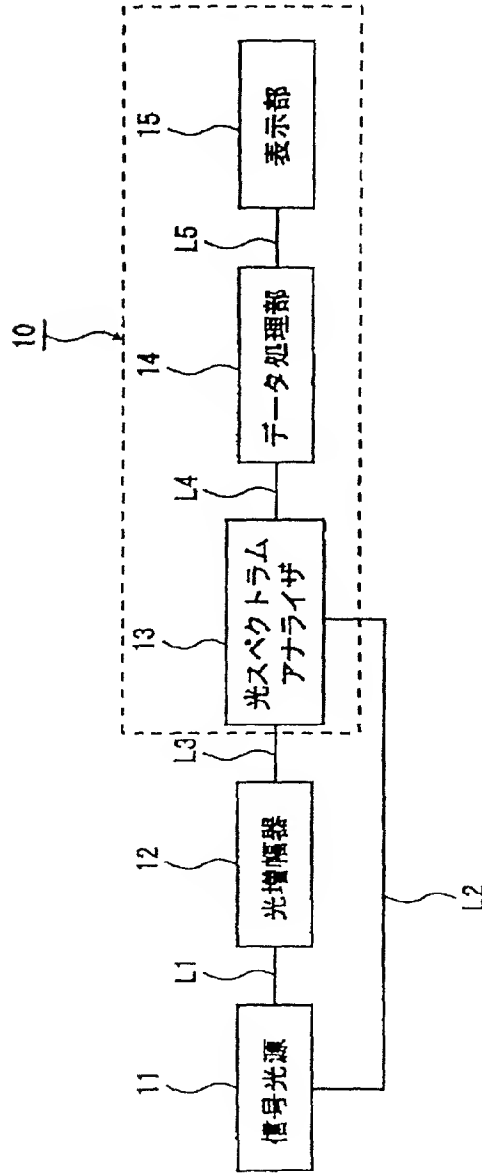
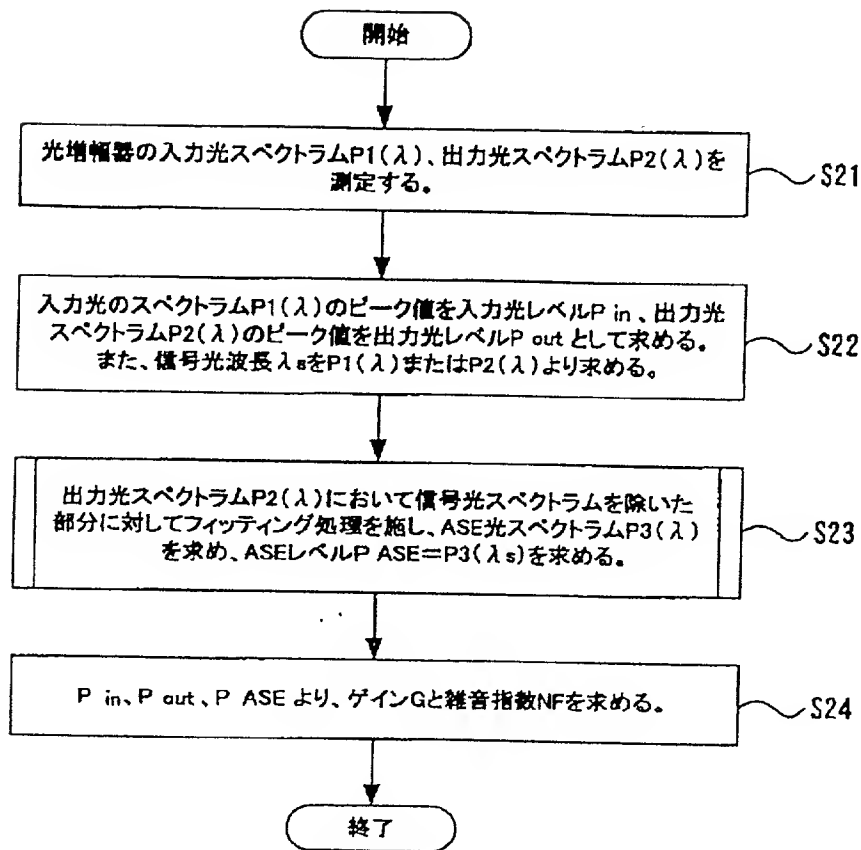


Fig. 1



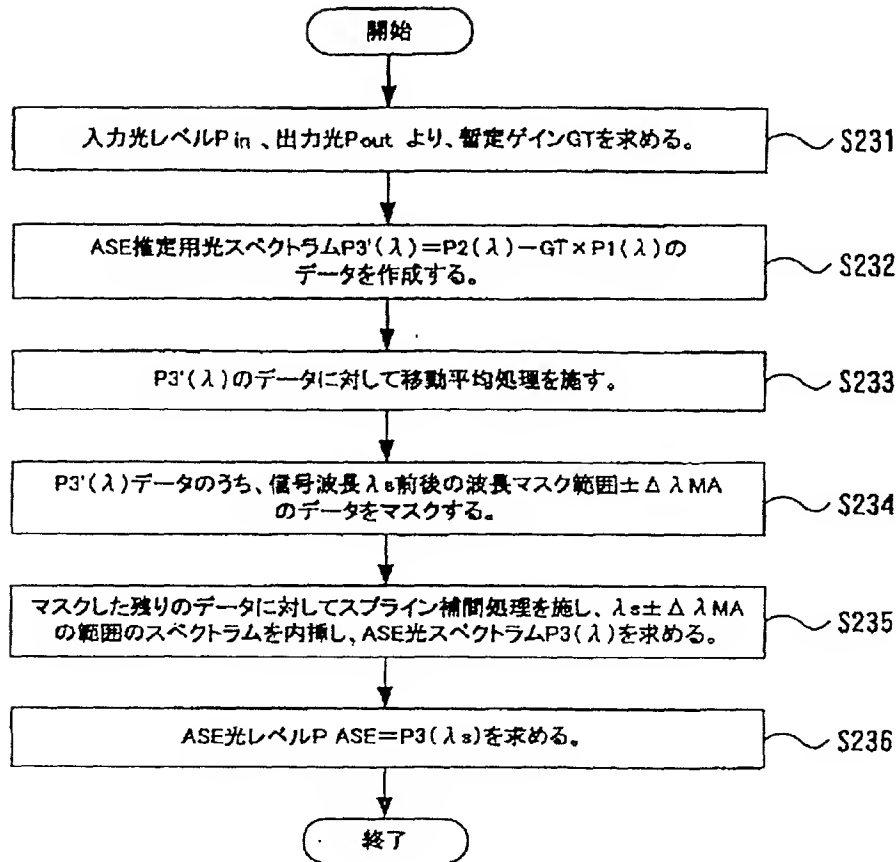
- 11 Signal light source
- 12 Optical amplifier
- 13 Optical spectrum analyzer
- 14 Data processing portion
- 15 Displaying portion

Fig. 2.



- S21: Measure input light spectrum  $P_1(\lambda)$  and output light spectrum  $P_2(\lambda)$ .  
 S22: Calculate peak value of input light spectrum  $P_1(\lambda)$  as an input light level  $P_{in}$ , and peak value of output light spectrum  $P_2(\lambda)$  as an output light level  $P_{out}$ . Calculate signal light wavelength  $\lambda_s$  based on  $P_1(\lambda)$  or  $P_2(\lambda)$ .  
 S23: Perform fitting process for portion excluding signal light spectrum in terms of output light spectrum  $P_2(\lambda)$  data to prepare an ASE spectrum  $P_3(\lambda)$  to calculate ASE light level  $P_{ASE} = P_3(\lambda_s)$ .  
 S24: Calculate gain  $G$  and noise figure  $NF$  based on  $P_{in}$ ,  $P_{out}$ , and  $P_{ASE}$ .

Fig. 3



- S231: Calculate provisional gain  $GT$  based on input light level  $P_{in}$  and output light level  $P_{out}$ .
- S232: Prepare data of light spectrum for assuming ASE  $P3'(\lambda) = P2(\lambda) - GT \times P1(\lambda)$ .
- S233: Perform moving average process for the data of  $P3'(\lambda)$ .
- S234: Mask data within a wavelength mask range of  $\pm \Delta \lambda_{MA}$  of  $P3'(\lambda)$  data before and after the signal wavelength  $\lambda_s$ .
- S235: Perform spline interpolation process for the remaining data after masking. Interpolate spectrum within range of  $\lambda_s \pm \Delta \lambda_{MA}$ . Calculate ASE light spectrum  $P3(\lambda)$ .
- S236: Calculate ASE light level  $P_{ASE} = P3(\lambda_s)$ .

Fig. 4A

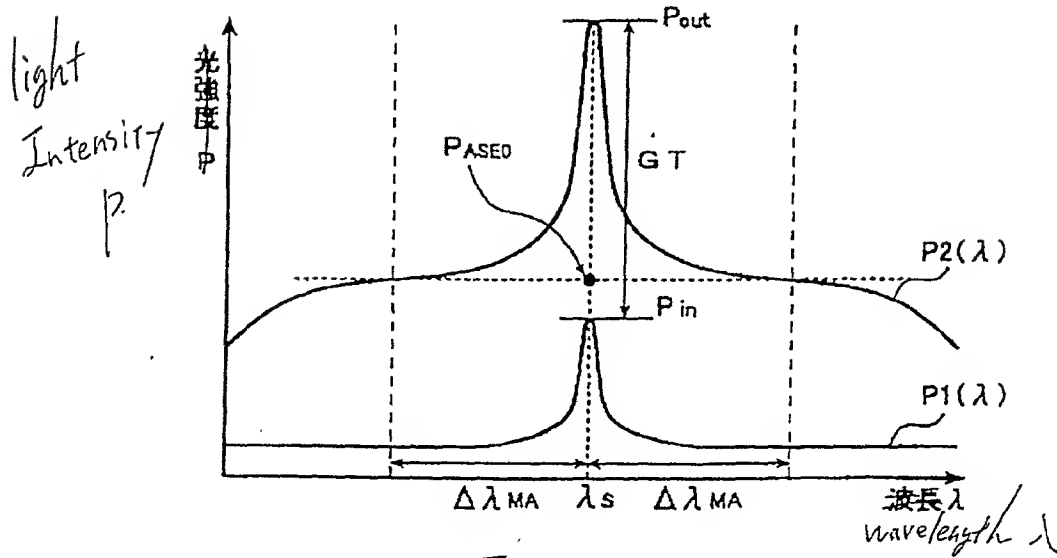


Fig. 4B

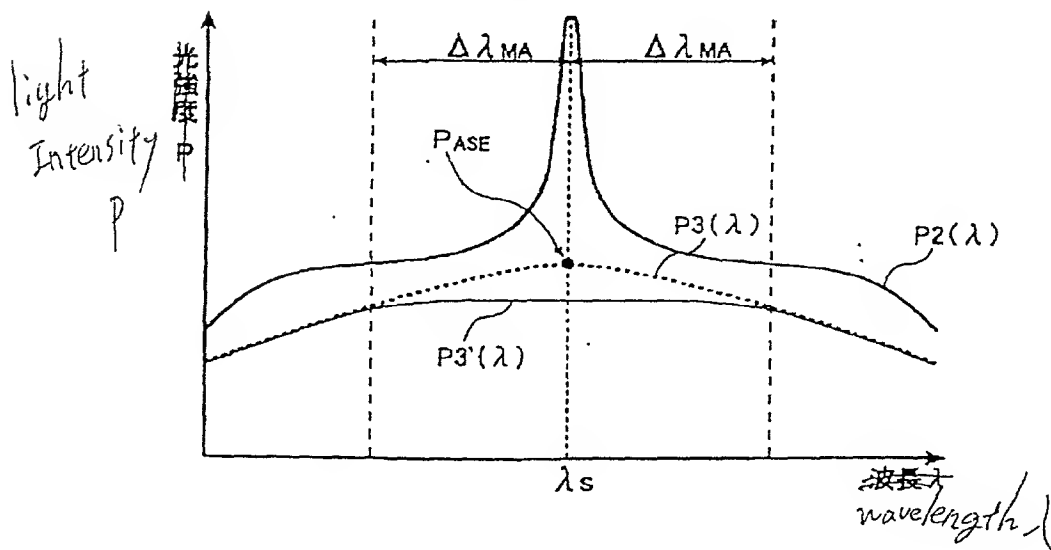
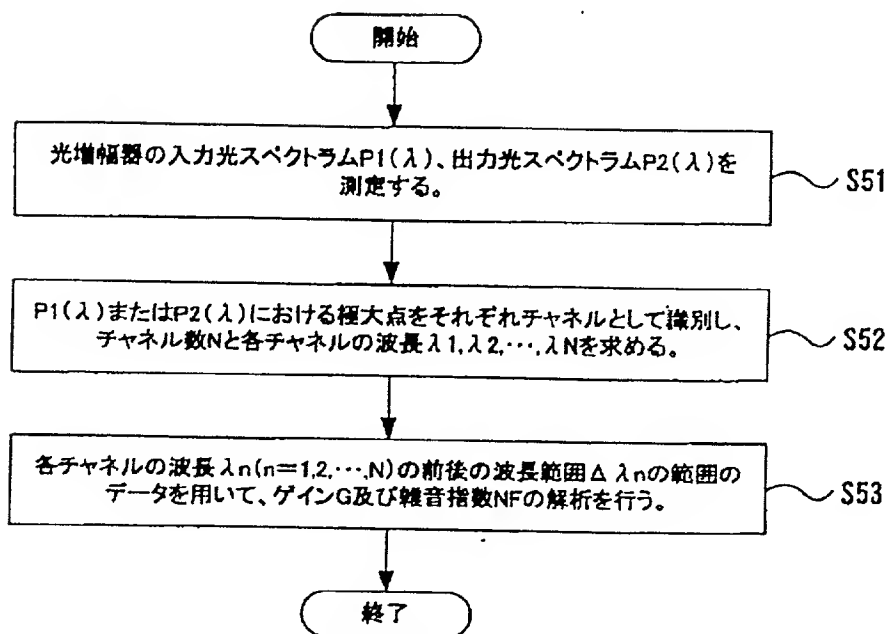


Fig. 5



- S51: Measure input light spectrum  $P1(\lambda)$  and output light spectrum  $P2(\lambda)$  of optical amplifier.
- S52: Recognize peak points in  $P1(\lambda)$  or  $P2(\lambda)$  as channels, respectively. Determine the number of channels and the wavelengths  $\lambda_1, \lambda_2, \dots, \lambda_N$  of respective channels.
- S53: Analyze gains  $G$  and noise figure  $NF$  by data within the range of  $\Delta\lambda_n$  before and after the wavelength  $\lambda_n$  ( $n=1, 2, \dots, N$ ) of each channel.

Fig. 6

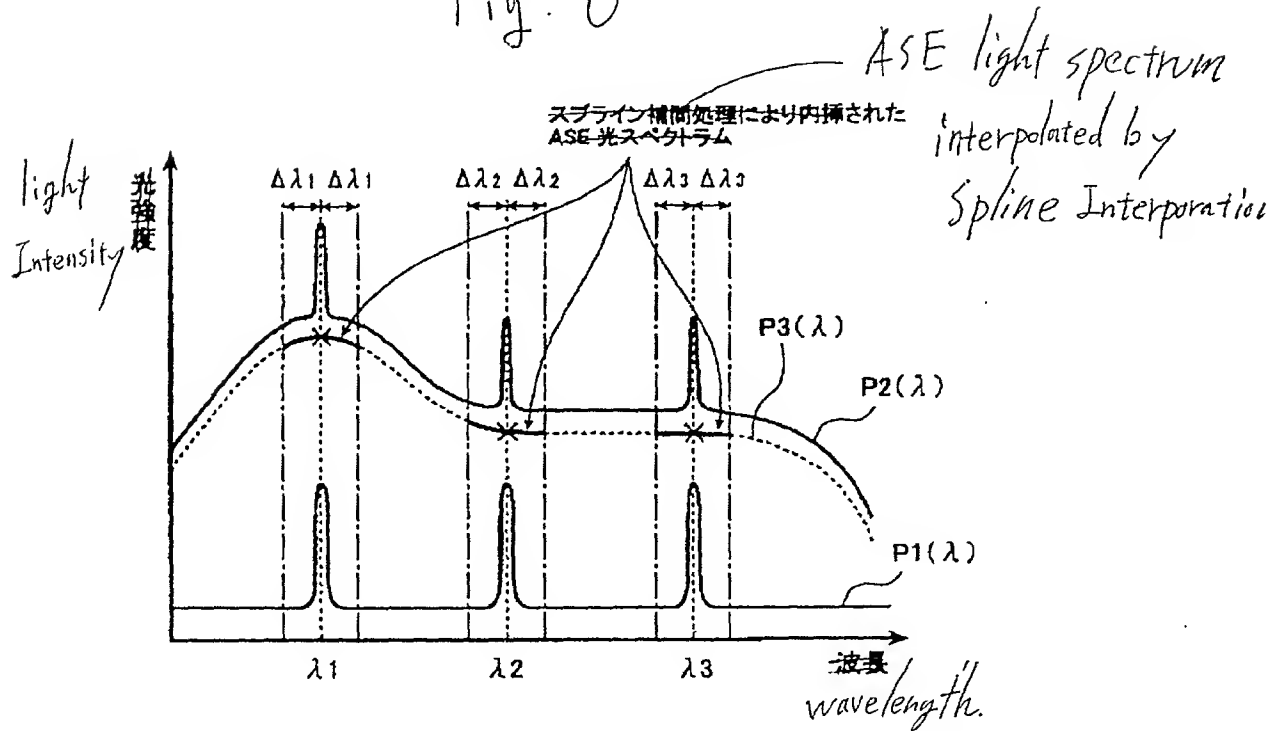
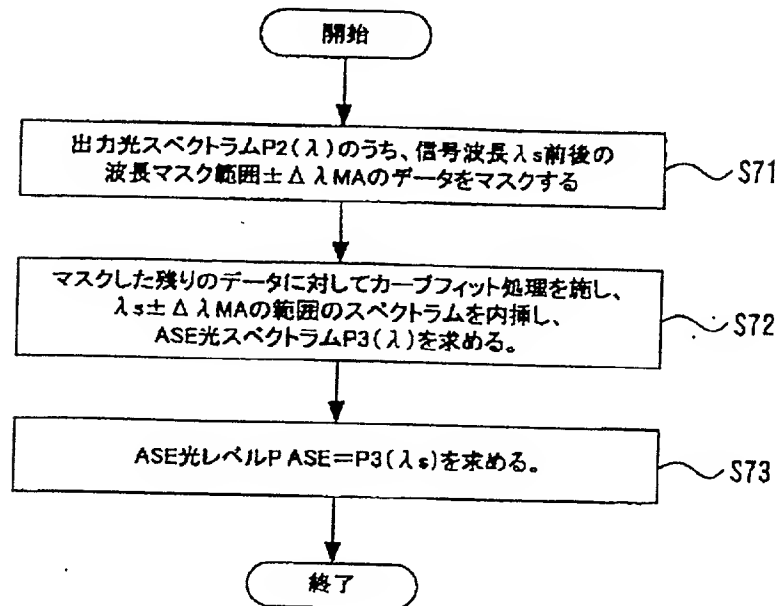
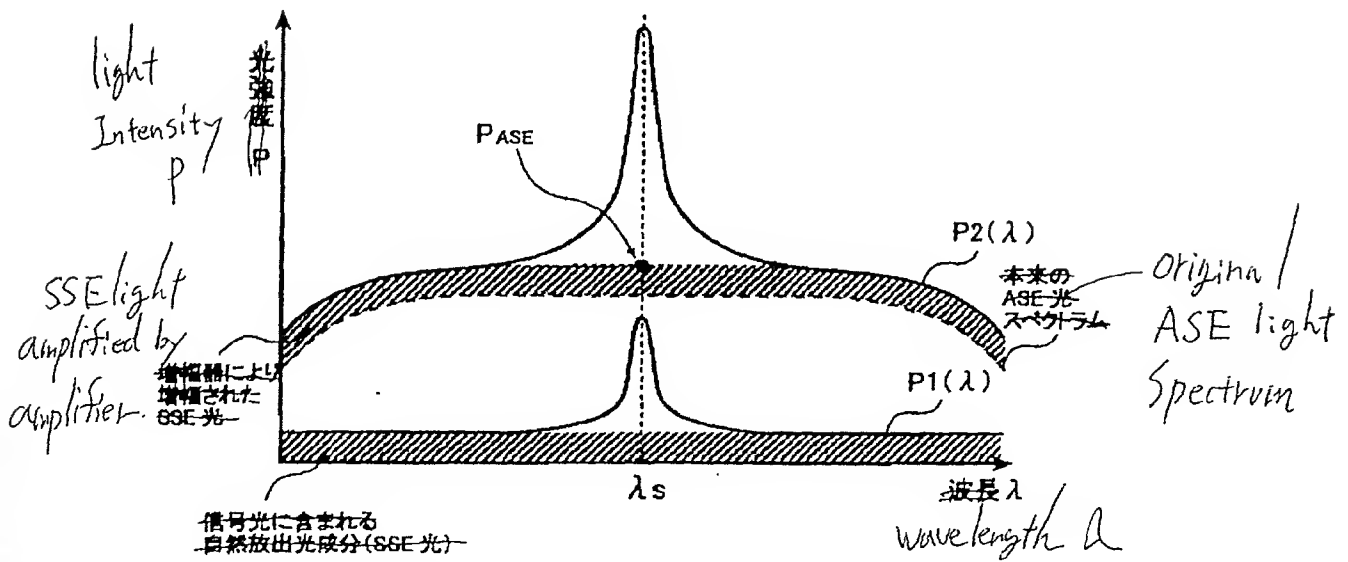


Fig. 7



- S71: Of the output light spectrum  $P2(\lambda)$ , mask data within wavelength mask range of  $\pm \Delta\lambda_{MA}$  before and after the signal wavelength  $\lambda_s$ .
- S72: Perform curve-fit process for the remaining data after masking. Interpolate a spectrum within the range of  $\lambda_s \pm \Delta\lambda_{MA}$ . Determine ASE light spectrum  $P3(\lambda)$ .
- S73: Determine ASE light level  $P_{ASE} = P3(\lambda_s)$ .

Fig. 8A



Source Spontaneous emission component (SSE light) contained in signal light

Fig. 8B

